IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of

KOHASHI

Atty. Ref.: 925-175

Serial No. 09/777,922

Group: 2828

Filed: February 7, 2001

Examiner: Rodriguez, A.

For: SEMICONDUCTOR LASER APPARATUS AND METHOD OF PRODUCING THE SAME

* *

December 23, 2002

Assistant Commissioner for Patents
Washington, DC 20231

APPEAL BRIEF

Sir:

Applicant hereby appeals the Final Rejection of August 13, 2002, Paper No. 12.

REAL PARTY IN INTEREST

The real party in interest is Sharp Kabushiki Kaisha, a corporation of the country of Japan.

RELATED APPEALS AND INTERFERENCES

The appellant, the undersigned, and the assignee are not aware of any related appeals or interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

STATUS OF CLAIMS

Claims 1-3 and 11-16 are pending and have been rejected. No claims have been substantively allowed.

STATUS OF AMENDMENTS

No amendments have been filed since the date of the Final Rejection.

SUMMARY OF INVENTION

The invention of the claims relates to a semiconductor laser apparatus.

Admitted Prior Art Figs. 5-6, which suffer from significant problems, are briefly discussed in order to provide a background for the summary of this invention. The prior art shown in Fig. 5 is directed to a semiconductor laser apparatus in which a laser chip 50 is bonded to a submout 51 using a metal soldering material 52. Unfortunately, because the metal soldering material 52 used to adhere chip 50 to submount 51 has a very high melting point and is too thin -- reflection problems occur (e.g., see from pg. 2, line 15 to pg. 3, line 3 of the instant specification). This reflection problem is further compounded because the soldering material 52 in Fig. 5 is so thin that it does *not* extend up the end surface(s) of the chip – thereby allowing a highly reflective end surface(s) of the chip to remain uncovered.

In contrast to the prior art of Fig. 5, the prior art of Fig. 6 does not use metal soldering material, but instead uses conductive die-bonding paste 56 to bond laser chip 50 to sub-mount 51. However, the semiconductor laser apparatus of Fig. 6 is problematic in that swelling of paste 56 causes the adhesive to extend up the opposing end surfaces of chip 50 thereby *covering up* the light emitting/receiving points thereof (see pages 4-5 of the instant specification).

The instant inventors have discovered a way in which to control the swelling of conductive die-bonding paste used for bonding a laser chip to a sub-mount or the like. In particular, the instant inventors have found that by pre-heating the sub-mount to a particular temperature(s), swelling of the conductive die-bonding paste can be controlled so as to allow the paste to move up the end surface of the chip but stop short of the light-emitting/receiving point(s) (e.g., see pgs. 11-14 of the instant specification). In certain embodiments, the conductive paste may comprise an epoxy resin and at least 80% by weight conductive filler particles such as silver.

Fig. 3 illustrates an example embodiment of this invention. In Fig. 3, a laser apparatus is illustrated which includes semiconductor laser chip 5 whose bottom is die-bonded to a bonding surface 1a of stem (or sub-mount) 1 with a conductive die-bonding paste 20. The semiconductor laser chip 5 has a light-emitting/receiving point 6, 7 at each of opposed end surfaces thereof. Because of the aforesaid pre-heating of the stem 1, it is possible to control swelling of the conductive die-bonding paste 20 so that the paste 20

adheres to a lower part of each end surface of the chip 5 (covering portions of the respective end surfaces of the chip that may be highly reflective) but stops short of the light-emitting/receiving point(s) 6, 7. In other words, in certain embodiments the highest position of the conductive die-bonding paste 20 on the lower part of each end surface of the semiconductor laser chip 5 is at a height of more than 0.01 mm from the bonding surface and hence from the bottom of the semiconductor laser chip, but is below the light-emitting point 6 and/or 7 of the chip. This is advantageous in that (a) the light-emitting/receiving point(s) of the laser chip are not covered up by the conductive paste thereby improving laser operation, and (b) regular reflection of an auxiliary beam does not occur due to the partial covering of the end surface(s) thereby leading to less noise generation (e.g., see pages 16-17 of the instant application).

An example technique for making a semiconductor laser apparatus according to certain embodiments of this invention is described on pages 11-14 of the instant specification. In summary, the stem 1 is preheated at about 60-80° C which is lower than the temperature at which the conductive die-bonding paste 2 starts a thermosetting reaction. The conductive die-bonding paste 2 is high in viscosity and swells in the shape of a drop of water on a surface immediately after it has been applied to the stem 1, as shown in Fig. 2A. The preheating reduces the viscosity of the conductive die-bonding paste 2, thereby reducing swelling so that paste 2 diffuses to form a preheated thin paste as shown in Fig. 2B. Accordingly, the preheating at a temperature in the range of 60 -

80°C reduces the viscosity of the conductive die-bonding paste so as to reduce swelling thereof, without causing hardening of the paste (e.g., see pg. 12 of the instant specification). After the semiconductor laser chip 5 is mounted on the preheated conductive die-bonding paste 20, the paste is heated to a heightened temperature in order to start the thermosetting reaction, whereby the conductive die-bonding paste 20 is fully hardened or set. As a result of this technique, swelling of the paste is controlled so that the paste swells upward across part of the end surface(s) of the laser chip but that swelling is *limited* so that it does not swell or rise above a main-discharge-side light-emitting point 6 or a monitoring-side light-emitting point 7 of the semiconductor laser chip 5 (each light-emitting point may be at a height of about 0.05 mm).

In certain embodiments of this invention, the laser apparatus may be used in an optical pick-up using a three beam scheme (e.g., see pgs. 13-14 of the instant specification). In such embodiments, of the three beams, the main beam returns to the light-emitting point, whereas one auxiliary beam travels above the semiconductor laser chip 5 and the other auxiliary beam is scattered by the conductive die-bonding paste 20 but is not regularly reflected on the discharge surface of the semiconductor laser chip 5. As a result, the auxiliary beams do not return to an optical detector thereby reducing generation of noise.

ISSUE

1. Whether claims 1-3 and 11-16 are unpatentable under 35 U.S.C. Section 103(a) over Admitted Prior Art (Figs. 5-6 of the instant application) in view of Honda (U.S. Patent No. 6,210,811).

GROUPING OF CLAIMS

Claims 1-3 stand or fall together. No other claim stands or falls with any other claim. In other words, while claims 1-3 stand/fall together, each of the other claims is patentably distinct in and of itself. The explanations set forth below, with respect to each claim group, are indicative of the below-listed claim groups and include the reasons therefor.

Thus, the claims are grouped as follows:

Group A: claims 1-3

Group B: claim 11

Group C: claim 12

Group D: claim 13

Group E: claim 14

Group F: claim 15

Group G: claim 16

ARGUMENT

The USPTO has the burden under 35 U.S.C. Section 103 of establishing a *prima facie* case of obviousness. In re Piasecki, 745, F.2d 1468, 1471-72, 223 USPQ 785, 787-88 (Fed. Cir. 1984). It can satisfy this burden only by showing that some objective teaching in the prior art, or that knowledge generally available to one of ordinary skill in the art, would have led that individual to combine the relevant teachings of the references to arrive at the claimed invention. In re Fine, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Before the USPTO may combine the disclosures of the references in order to establish a *prima facie* case of obviousness, there must be some suggestion for doing so. In re Jones, 958 F.2d 347 (Fed. Cir. 1992). Even assuming, *arguendo*, that a given combination of references is proper, the combination of references must in any event disclose the features of the claimed invention in order to render it obvious.

A. Claims 1-3

Claim 1 stands rejected under 35 U.S.C. Section 103(a) as being allegedly unpatentable over Admitted Prior Art (APA) (Figs. 5-6 of the instant application) in view of Honda. This Section 103(a) rejection should be reversed for at least the following reasons.

Claim 1 requires that "the conductive die-bonding paste adheres to a lower part of each end surface of the chip, and a highest position of the conductive die-bonding paste

on said lower part of each end surface of the semiconductor laser chip is at a height of more than 0.01 mm from the bonding surface and hence from the bottom of the semiconductor laser chip, but is below the light-emitting point of the semiconductor laser chip." In other words, claim 1 requires that the conductive die-bonding paste extend upwardly along part of each end surface of the laser chip, but stop short of reaching the light-emitting point. Referring to Fig. 3 of the instant application for example, it is shown that the swelling of conductive die-bonding paste 20 is controlled so that the paste 20 extends upwardly and adheres to a lower portion of each end surface of the laser chip 5; but that the paste 20 does not reach or cover up the light emitting point 6 and/or 7 at the end surface(s). The cited art fails to disclose or suggest the aforesaid quoted and underlined aspect of claim 1.

Both APA Fig. 5 and APA Fig. 6 fail to disclose or suggest the aforesaid quoted aspect of claim 1. APA Fig. 5 is deficient because the metallic solder material used for bonding does not extend up either end surface of the laser chip. Accordingly, as explained above, APA Fig. 5 is problematic since the metal soldering material used to adhere the chip has a high melting point and is too thin and cannot extend up either chip end surface, thereby leading to the occurrence of reflection problems (e.g., see from pg. 2, line 15 to pg. 3, line 3 of the instant specification). Moreover, the metallic solder material of APA Fig. 5 is not a conductive die-bonding paste.

In contrast with APA Fig. 5, APA Fig. 6 does disclose conductive die-bonding paste (not solder) which extends up the end surfaces of the laser chip. However, APA Fig. 6 is problematic in that paste swelling cannot be limited, thereby leading to the paste covering up the light emitting/receiving point(s) of the chip as shown in Fig. 6.

Accordingly, it can be seen that APA Fig. 5 and APA Fig. 6 both ***fail*** to disclose or suggest a conductive die-bonding paste which "adheres to a lower part of each end surface of the chip, and a highest position of the conductive die-bonding paste on said lower part of each end surface of the semiconductor laser chip is at a height of more than 0.01 mm from the bonding surface and hence from the bottom of the semiconductor laser chip, but is below the light-emitting point of the semiconductor laser chip" as required by claim 1. Instead, APA Fig. 5 teaches directly away from this aspect of claim 1 by using a metal solder which does not adhere to any end surface portion of the chip; and APA Fig. 6 teaches directly away from this aspect of claim 1 by having a paste which undesirably covers up the light emitting point(s) of the chip.

The Office Action contends that it would have been obvious to have used Honda's epoxy resin in the devices of APA Figs. 5-6. However, Honda is similarly flawed in that like APA Figs. 5-6, Honda fails to disclose or suggest a paste which "adheres to a lower part of each end surface of the chip, and a highest position of the conductive die-bonding paste on said lower part of each end surface of the semiconductor laser chip is at a height of more than 0.01 mm from the bonding surface and hence from the bottom of the

semiconductor laser chip, but is below the light-emitting point of the semiconductor laser chip" as required by claim 1. *It can be seen that no cited reference discloses or suggests this aspect of claim 1. Thus, even if the references were combined (which applicant believes would be incorrect in any event), the invention of claim 1 still would not be met.*

Moreover, if the epoxy resin of Honda was used in either of APA Figs. 5-6, this would likely result in a structure with the same problem as Fig. 6 where the light-emitting point of the chip is covered. In other words, the alleged combination of APA Fig. 5 and Honda would result in APA Fig. 6 - - which the Office Action admits fails to meet claim 1. There is no disclosure or suggestion in the art of record of preheating the stem or mount in a manner which would result in the structural invention of claim 1. Thus, even if the cited art was combined, the invention of claim 1 still would not be met.

Finally, it appears as if the Office Action contends that using a conductive die-bonding paste which extends up parts of the end surfaces of a laser chip but which stops short of the light emitting point would have been an obvious matter of design choice and would have involved "only routine skill in the art." This contention is fundamentally flawed for the reasons discussed above (i.e., using the processing of the cited art, this claimed feature is impossible to achieve). Moreover, the Board of Appeals has correctly observed that such a statement/allegation by an Examiner is a "concession that the art contains no suggestion" of the claimed limitations. *Ex parte Dere*, 118 U.S.P.Q. 541 (Bd. of App. 1957). The Board has further observed that "only the disclosure of the instant

case makes a 'choice' available." *Ex parte Krantz*, 61 U.S.P.Q. 238 (Bd. of App. 1943); and *Ex parte Haas*, 144 U.S.P.Q. 98 (Bd. of App. 1964). Thus, the Office Action's contention that the claimed feature is a mere matter of design choice is an admission that no art exists with respect to such claimed limitations. As such, no showing of *prima facie* obviousness has been established under Section 103.

B. Claim 11

Claim 11 requires that "the highest position of the conductive die-bonding paste on said lower part of each end surface is within 0.04 mm of the light-emitting point." In other words, claim 11 requires that the conductive die-bonding paste extend up part of each end surface of the laser chip to a point within 0.04 mm of the light-emitting point, without covering the point. The cited art fails to disclose or suggest this aspect of claim 11, either alone or in the alleged combination.

C. Claim 12

Claim 12 requires that "the conductive die-bonding paste comprises epoxy resin and at least 80% by weight conductive filler of metal particles." For example, see the instant specification at page 11, lines 3-5. While the cited art mentions silver particles, there does not appear to be any disclosure of suggestion of using an epoxy resin as recited in claims 1 and 12 where the resin includes at least 80% by weight of conductive filler of metal flake particles. Impermissible hindsight is not permitted.

D. Claim 13

Claim 13 requires that "a highest position at which the conductive die-bonding paste adheres to at least one end surface of the semiconductor laser chip is at a height of more than 0.01 mm from the bonding surface, but is below the light-emitting point of the semiconductor laser chip; and wherein the conductive die-bonding paste comprises epoxy resin and at least 80% by weight conductive filler of metal particles or flakes." Claim 13 thus requires that the conductive die-bonding paste extends upwardly along at least one end surface of the laser chip, but stops short of covering the light-emitting point; and that the paste includes at least 80% by weight conductive filler of metal particles or flakes. The cited art fails to disclose or suggest these aspects of claim 13, whether taken alone or in combination.

As explained above, no cited reference discloses or suggests these aspects of claim 13. Thus, even if the references were combined, the invention of claim 13 still would not be met. The art of record is entirely unrelated to claim 13 in these respects.

E. Claim 14

Claim 14 requires that "the conductive die-bonding paste adheres to a lower part of each end surface of the chip from the bottom up to a height below the light emitting point so that when the apparatus is used in the optical pickup an auxiliary beam directed from an optical disk to the lower part of one of the end surfaces is scattered by the conductive die-bonding paste adhering thereto." The cited art fails to disclose or suggest these aspects of claim 14.

As explained above, no cited reference discloses or suggests that a "conductive die-bonding paste adheres to a lower part of each end surface of the chip from the bottom up to a height below the light emitting point" as required by claim 14. Even given the alleged combination, it would be impossible to meet the invention of claim 14, since the alleged combination would merely result in APA Fig. 6 in which the light emitting point is covered up. There is no disclosure or suggestion in the cited art of any sort of pre-heating which would enable the structural invention of claim 14 to be met.

F. Claim 15

Claim 15 requires that "a highest position of the conductive die-bonding paste on said lower part of each end surface of the chip is at a height of more than 0.01 mm from the bottom of the chip." The cited art fails to meet this aspect of claim 15. Even given the alleged combination, it would be impossible to meet the invention of claim 15, since the alleged combination would merely result in APA Fig. 6 in which the light emitting point is covered up. There is no disclosure or suggestion in the cited art of any sort of pre-heating which would enable the structural invention of claim 15 to be met.

G. Claim 16

Claim 16 requires that "a highest position of the conductive die-bonding paste on said lower part of each end surface of the chip is within 0.04 mm of the light emitting point." Claim 16, via claim 14 on which it depends, also clearly requires that the light emitting point not be covered up by the paste. The cited art, whether taken alone or in

combination, fails to meet this aspect of claim 16. Even given the alleged combination, it would be impossible to meet the invention of claim 16, since the alleged combination would merely result in APA Fig. 6 in which the light emitting point is covered up. There is no disclosure or suggestion in the cited art of any sort of pre-heating which would enable the structural invention of claim 16 to be met.

CONCLUSION

In conclusion it is believed that the application is in clear condition for allowance; therefore, early reversal of the Final Rejection and passage of the subject application to issue are earnestly solicited.

Respectfully submitted,

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APPENDIX

CLAIMS ON APPEAL

1. A semiconductor laser apparatus comprising a semiconductor laser chip whose bottom is die-bonded to a bonding surface with a conductive die-bonding paste, said semiconductor laser chip having a light-emitting point at each of opposed end surfaces thereof,

wherein the conductive die-bonding paste adheres to a lower part of each end surface of the chip, and a highest position of the conductive die-bonding paste on said lower part of each end surface of the semiconductor laser chip is at a height of more than 0.01 mm from the bonding surface and hence from the bottom of the semiconductor laser chip, but is below the light-emitting point of the semiconductor laser chip.

2. A semiconductor laser apparatus according to claim 1, wherein said conductive die-bonding paste contains an epoxy resin as a base material.

3. A semiconductor laser apparatus according to claim 1, wherein said conductive die-bonding paste contains silver flakes as a conductive filler.

11. The apparatus of claim 1, wherein the highest position of the conductive die-bonding paste on said lower part of each end surface is within 0.04 mm of the light-emitting point.

12. The apparatus of claim 1, wherein the conductive die-bonding paste comprises epoxy resin and at least 80% by weight conductive filler of metal particles of flakes.

13. A semiconductor laser apparatus comprising:

a semiconductor laser chip die-bonded to a bonding surface with a conductive die-bonding paste, said semiconductor laser chip having a light-emitting point at at least one end surface thereof,

wherein a highest position at which the conductive die-bonding paste adheres to at least one end surface of the semiconductor laser chip is at a height of more than 0.01 mm from the bonding surface, but is below the light-emitting point of the semiconductor laser chip; and

wherein the conductive die-bonding paste comprises epoxy resin and at least 80% by weight conductive filler of metal particles or flakes.

14. A semiconductor laser apparatus for use in an optical pickup using a three-beam scheme for optical disks, the semiconductor layer apparatus comprising a semiconductor laser chip whose bottom is die-bonded to a bonding surface with a conductive die-bonding paste, said semiconductor laser chip including a light-emitting point at each of opposed end surfaces thereof,

where the conductive die-bonding paste adheres to a lower part of each end surface of the chip from the bottom up to a height below the light emitting point so that when the apparatus is used in the optical pickup an auxiliary beam directed from an optical disk to the lower part of one of the end surfaces is scattered by the conductive die-bonding paste adhering thereto.

15. The apparatus of claim 14, wherein a highest position of the conductive die-bonding paste on said lower part of each end surface of the chip is at a height of more than 0.01 mm from the bottom of the chip.

16. The apparatus of claim 14, wherein a highest position of the conductive die-bonding paste on said lower part of each end surface of the chip is within 0.04 mm of the light emitting point.